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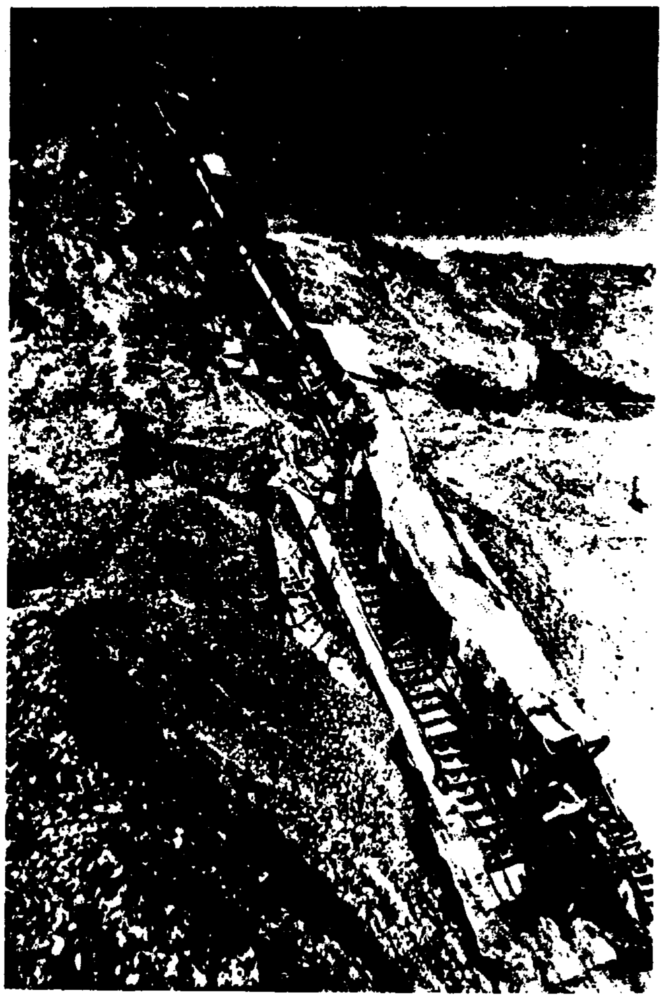

Figure 4. Inclined Launcher--Ground View (U)

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Director of
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Intelligence

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Project BABYLON—The Development, Capabilities, and Status of Iraq's "Super Gun" (U)

Committee Intelligence Report

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WSSIC 92-10002
February 1992

Approved for Release: 2012/07/11

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adoption of the "Super Gun" immediately limits the direction of future developments and places an "upper bound" on the available payload. The viability of SSM systems has been repeatedly demonstrated, while the use of GLRs for long-range bombardment has only been established as "technologically" possible. Its practicality remains questionable.

[redacted]

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The Weapon and Space Systems Intelligence Committee is a DCI Committee that includes representation from the following departments and agencies:

Department of the Army
Department of the Navy
Department of the Air Force
Central Intelligence Agency
Defense Intelligence Agency
National Security Agency
Department of State
Department of Energy
National Aeronautics and Space Administration

Warning Notice ~~Intelligence Sources or Methods Involved~~

National Security Information ~~Unauthorized Disclosure Subject to Criminal Sanctions~~

This page is ~~Confidential~~.

Project HARP

There was no real Western interest in the development of extremely long-range cannon artillery until initiation of the joint US-Canadian Project HARP in the 1960s. The Canadian project director was Dr. Bull, who believed that a cannon could be developed to place a satellite into earth orbit. By the end of the project, he had designed and begun testing gun-launched rockets. Funding for Project HARP was terminated in 1967, causing Dr. Bull to found SRC as a means of continuing work on what had become almost a personal obsession. Even the corporate logo reflects Dr. Bull's desire to see Project HARP carried to conclusion (Figure 2). [redacted]

SCOPE NOTE

This report was prepared and coordinated by the [redacted] Weapon and Space Systems Intelligence Committee (WSSIC). [redacted] It contains an analysis of the development, capabilities, and current status of the Iraqi Project BABYLON, more commonly known as the project to develop a "Super Gun." The report is intended to provide sufficient detail for the Intelligence Community to understand the goal of the project, the basic design and engineering concepts of the system, and the latest information on its current status. [redacted]

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In both cases, the system must be aerodynamically stable and the total "launch" weight must be low enough so that the first stage can actually produce "lift off".

The GLR has an advantage over the SSM when an existing system is modified in order to increase range. Range increase for an SSM generally requires either increasing the system weight (and therefore the weight which the first stage must lift) or decreasing the payload to increase the rocket motor size. Although a GLR payload can be reduced to increase range, two additional techniques can be used. First, the propelling charge can be increased to produce a higher muzzle velocity, although this technique has finite limits based on the design of the cannon. Analogous to increasing the weight of the SSM, this technique does not increase the "lift-off" weight of the system. It is also possible to modify the motor of the GLR. While this is essentially the same technique that can be applied to SSMs, a GLR requires a smaller force to increase acceleration than would be required to accelerate a slower-moving SSM. While modifying a given SSM design can achieve a payload advantage at relatively short ranges (300 km or less), the GLR can generally retain a greater payload when <u>both</u> systems are <u>modified</u> to increase range.

The ATI designers clearly identified the two major limitations of GLRs--the fixed launcher cannot be trained on more than one target and the poor accuracy of unguided, cannon-launched projectiles prevents the effective engagement of long-range targets. The solution to both problems is the use of a guidance system. A guidance system can be used to initially "steer" the GLR after launch, thus providing the equivalent of a small amount of cannon traverse. The use of either a terminal-guided or terminal-homing munition allows different targets to be engaged and increases the accuracy of the GLR, thus making long-range bombardment practical. The chief limitation on the use of GLR guidance is the fact that the electronics must be sufficiently hardened to withstand the increased firing shock from the cannon. This was successfully demonstrated during Project HARP, but the hardening makes comparable guidance systems more expensive in GLRs than in SSMs.

Clearly, the "Super Gun" was not adopted by the world's armies for a number of reasons, not the least of which was an inability to view the concept as a viable surface-to-surface weapon system. Additional reasons have been the fact that

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System 1000

The 150-caliber 1000-mm system was intended for the long-range bombardment of military and economic targets. The System 1000 was designed for emplacement in a fixed position, probably similar to that of the System 350. Construction of a horizontal test facility was begun at a site near the Al Mussayib Artillery Test Range. A complete set of the cannon sections and recoil cylinders had been delivered to Iraq by March 1990. These System 1000 components were still located in a storage area at the Iskandariyah Motor Vehicle Plant, where they were first seen in February 1990, and were destroyed by a United Nations team in October 1991 (Figure 5). Although it cannot be confirmed, the site for the final installation may have been selected and the supporting civil engineering begun.

System 350ET

With the successful testing of the System 350, Iraq directed ATI to develop a "weaponized" 350-mm cannon system. The System 350ET is smaller and was designed to be capable of limited elevation and traverse, hence the suffix ET. Because the System 350ET was intended to fire GLR, the cannon's caliber length could be reduced, with range increases being achieved as part of the rocket's design. Many of the system components were to have been completed by March 1990 and shipped the following month. As with the System 350, the cannon components were apparently first to be shipped to Sinjar for proof testing, after which they would be shipped to the installation site. To date, the status of this work and the location of the firing site cannot be determined. Available evidence suggests that several critical components for the system were never ordered, and European customs officials have seized several additional components, including both of the cradles and at least one recoil cylinder. The civil engineering work at the firing site has reportedly been completed.

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[redacted]

The Iraqi Connection

The Iraqi point of contact for Project BABYLON was the State Organization for Technical Industries (SOTI), headed by Lieutenant General Dr. Saadi. The specific project officer was Brigadier Dr. Azzawi, who has an engineering degree and served as the Iraqi technical project manager. As with other SRC-administered projects, the basic contract between ATI and SOTI included a work allocation clause stipulating the work to be done by Iraq. Iraq was responsible for all civil engineering support for the project and for manufacturing a number of systems components. The management of this work was the responsibility of SOTI and appears to have involved several factories and state establishments. The following Iraqi state establishments and offices have been mentioned in internal Project BABYLON reports:

- Nasser Establishment
- Saddam Establishment
- Badr Establishment
- Dura Establishment
- Petroleum Establishment
- General Workshop
- Al Kindy Research and Development Facility

[redacted]

Project BABYLON Phase I

The goal of the first phase of Project BABYLON was the development of the System 1000 gun--a 150-caliber, fixed-orientation cannon which would fire GLRs. In order to achieve that goal a developmental cannon, the System 350, was used to refine the designs for the System 1000 gun's components and projectiles. Much of the work proceeded concurrently in order to reduce the development time. However, there were several distinct steps in this first phase, each of which produced a separate, distinct gun system.

[redacted]

System 350H

The first gun scheduled for assembly was the System 350H, a horizontally emplaced 150-caliber gun to be used for initial

BACKGROUND

Iraq Exposed

Iraq's development of truly strategic artillery was publicly revealed in early 1990, when customs officials in the United Kingdom, Italy, Germany, Switzerland, Greece, and Turkey seized shipments of materiel bound for Iraq. These shipments contained components for what immediately became known as the "Super Gun," a long-range artillery project designed by the Brussels-based Space Research Corporation (SRC) and its founder, the late Dr. Gerald V. Bull. His work had two historic precedents--cannon systems developed by the Germans during the World Wars I and II. (U)

World War I

On 23 March 1918, the Germans began a long-range artillery bombardment of Paris with three, large-caliber guns from a range of 128 km. The "Paris Guns" were of varying caliber, since successive rounds caused enough erosion to rapidly wear down the cannon bore. The guns initially fired 210-mm projectiles, then 240-mm projectiles, and finally 260-mm projectiles before the cannon had to be replaced. By August, the Germans had fired a total of 303 projectiles, of which 183 fell within the city and killed 256 people. Although the employment of these three guns produced little, significant, material damage, it provoked a major response from the French. French artillery units fired more than 5000 rounds of ammunition at the Paris Guns in order to silence them. The guns were withdrawn to Germany and destroyed before the firing positions were captured by ground attack. (U)

World War II

During World War II, the Germans developed the largest cannon system ever employed in combat. The 800-mm gun "DORA" (Figure 1) was used at the siege of Sevastopol in 1942, where it gained fame by destroying a Soviet ammunition bunker buried under 30 meters of earth. Only five of the 48 7-ton armor-piercing projectiles fired by the DORA hit their target, although the range was only 48 km. Despite being classed as a railroad gun, the DORA was not a mobile system. It weighed 1350 tons and had to be disassembled and shipped in 50 railroad cars. At the firing site, a special curved pair of railroad tracks had to be built to support the gun. (U)

PROSPECTS FOR THE FUTURE

With the UN-supervised destruction of available components and ammunition completed, Project BABYLON would appear to have been terminated. Iraq obviously cannot afford the project now, and the success or failure of the political and economic reconstruction of the country will determine if Iraq is ever able to contemplate restarting the project. Should the decision be made to proceed, new suppliers will have to be found. Iraq probably has sufficient technical drawings to construct any of the cannons. The production of components originally manufactured in Europe will depend on finding qualified manufacturers, probably in China, South Korea, Yugoslavia, and possibly Japan. The majority of the sophisticated design and engineering work could clearly be accomplished in China and South Korea, countries already linked to Iraq and possibly to Project BABYLON. Project leadership without Gerald Bull will probably require the formation of a "design committee," since it is unlikely that any single individual could replace him. This will undoubtedly slow decisionmaking and extend the development time (with an attendant cost increase). There is limited evidence that other countries are interested in undertaking the project, but its cost and high visibility may preclude such an undertaking. In the end, Dr. Bull's demise may yet represent the "death knell" for Project BABYLON and the future prospects of the "Super Gun."

housed in a structure built over the lower third of the cannon. This provided environmental protection for the crew, the ammunition, and the cannon system. Underground facilities in the immediate vicinity of the gun may have been used for the storage of equipment used during loading. Security for the facility was apparently achieved principally through its remote location. [redacted]

System 350ET

The design of the System 350ET was a radical departure from construction techniques used on the other large-caliber systems. But, it is similar, in some respects, to the design of the hypervelocity gun. The 36-caliber cannon for the System 350ET was constructed in three sections that were to be joined together and sealed. A large machined cradle was to support the cannon during recoil as well as during traverse and elevation. The traverse and elevation mechanism designs were unique, principally because of their scale. Elevation of the cannon was to be controlled with a hydraulic piston and a fixed pivoting arm mounted below the cannon. The piston of the elevating cylinder, anchored to the floor of the "L-shaped" foundation, acted horizontally on the lower end of an elevating arm. The elevating arm was designed to be connected to a "tension link" which would serve as a fulcrum. This would make it possible to get a wide range of movement in the elevating arm from a limited amount of movement by the elevating cylinder. The upper end of the elevating arm was to be attached to a collar mounted on the center section of the cannon. As the hydraulic piston retracts, the collar would move toward the breech-end of the cannon, thereby elevating the cannon. Equilibration was unnecessary since the trunnions were mounted at the approximate center-of-balance of the cannon. The cannon would use a fairly conventional traverse mechanism, and was designed to have traverse limits of approximately 20° right and left of center. Its elevation limits were 0° and 50°. The cannon would have to be lowered to the horizontal position for loading. A rate of fire of one round every hour would have been practical. [redacted]

System 1000

The design and construction of the System 1000 were virtually identical to those of the System 350. The only major difference was the fact that the System 1000 required four recoil cylinders instead of the two used on the smaller system. The ammunition handling crane was also designed

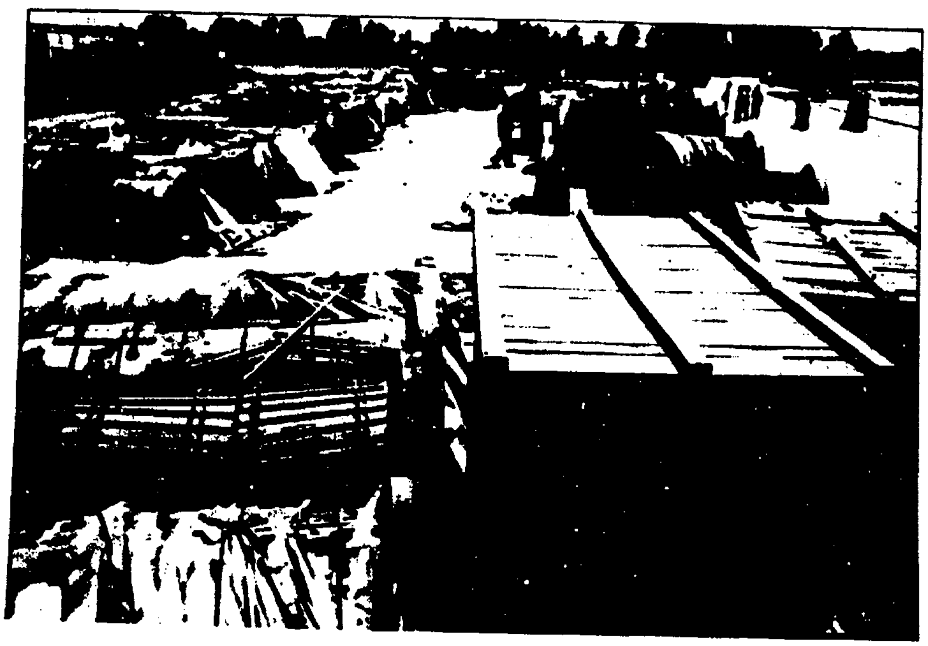

Figure 5. System 1000 Components at Iskandariyah (U)

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SYSTEM TECHNICAL CHARACTERISTICS

System 350

Since System 350 was a design and manufacturing vehicle for the System 1000, it was designed and constructed in the same manner as the larger system.

The 150-caliber cannon was constructed of 26 separate sections which were connected together at the firing position. This procedure was unnecessary from the standpoint that the System 350 cannon was relatively small. However, it was done so that manufacturing and construction experience could be gained on a "scale model" of the larger gun. The cannon is suspended within seven slide supports to accommodate recoil. These slide supports were mounted on frames attached to the concrete foundation. A bore liner was added to each cannon section. Separate seals were placed between each of these lined sections to keep propellant gases from escaping.

The recoil mechanism was attached to the breechblock, with the recoil pistons attached to a large stationary yoke. Unlike most cannon systems in which the piston is attached to the breechblock and the cylinder is fixed, the reverse arrangement was chosen for the System 350 in order to increase the recoiling mass. By increasing the recoiling mass, total recoil could be limited to approximately 2 meters. Counterrecoil was provided through a separate external foundation-mounted hydraulic system which pushed the cannon back into battery. Because of the size of the System 350, only two recoil cylinders were used. Although original designs called for the use of an interrupted, screw-type, breechblock with a cased propelling charge, this was changed during testing and for the final system design. The System 350 used a split sliding wedge breechblock consisting of a breech ring and two large vertically sliding plates. The smaller forward plate rested against the base of the propelling charge case, and the larger, second plate served to seal the breech. Both plates were lifted by a winch in order to open the breech.

To fix the System 350 at a 45° firing elevation, the entire system is emplaced along the side of a hill. The foundation was recessed into a cut in the hillside, and the breech area

Gun-Launched Rockets

The GLRs for Project BABYLON (Figure 7) are more correctly described as rockets fired from the cannon rather than projectiles fitted with a rocket motor. Several GLR designs had been developed and tested. [redacted]

The original GLR design was based on an easily manufactured, fixed-fin, discarding-sabot, solid-fueled rocket. A protective plate covering the base of the rocket would prevent propelling gasses from damaging the GLR in the cannon and provide an even distribution of the pressures across the base of the projectile. To prevent damage to the rocket motor nozzle during firing, a liquid buffer was designed to surround the nozzle. After leaving the muzzle, the pusher plate and sabots would discard, and the fluid surrounding the rocket nozzle would vent to the air. Identified changes to this design apparently concentrated initially on the sabots and the pusher plate in order to reduce their weight. The final designs for the GLR call for fold-out fins and a Teflon-coated projectile. The use of fold-out fins would allow the GLR to be full-caliber, thus increasing the available payload and the maximum range. The Teflon coating is a method of reducing wear of the smoothbore cannon caused during firing. [redacted]

The GLR for the System 350 was designated the S36. Although designed with space for a G&C package, there is no indication that such a package was available. Two sabot designs had been prepared, the preferred method being the use of composites. Although there is no indication that any S36 had been constructed, Iraq has detailed plans for the projectile's construction. The ballistic performance of the projectile would vary based upon the design and payload weight. [redacted]

The GLR for the System 1000 was designated the S46 and reflects experiences gained with both the S31 and the S44. Like the S31, the projectile would have a maraging steel fuselage (a steel which has increased tensile strength without becoming brittle). The S46 was configured for canard-controlled guidance, while the S31 was configured for tail-control. The S46 was designed to carry a 500-kg high explosive payload to a range of 700 km. Although ATI proposals and design drawings relied heavily on the GLR designed for Project HARP, no information is available (other than the fact that pop-out fins are used) on the design actually selected for the S46. [redacted]

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MARTLET 4A, 4B, and 4C: S-1000 SYSTEM

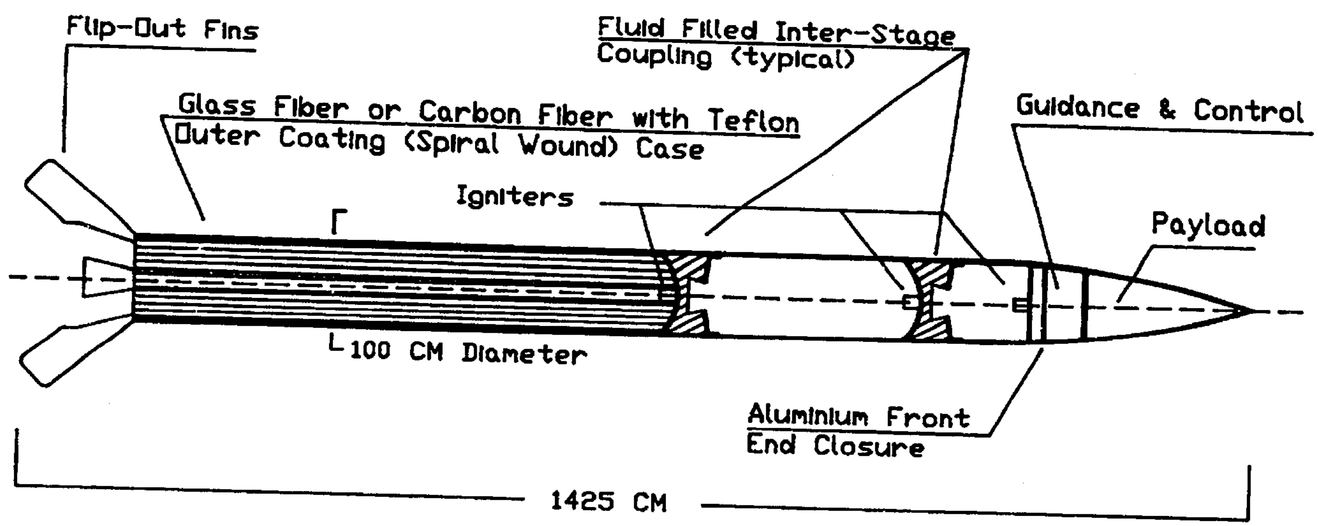

Figure 7. Design of the MARTLET 4 GLR (U)

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Propelling Charges

As of March 1990, the development efforts for the propelling charges continued to involve a variety of options. Three different grain designs and sizes of M8M propellant had been tested using bagged increments. A contract for the development of combustible cartridge cases had been let prior to March 1990. The initial System 350 firings used bagged, propelling-charge increments and a stub case for obturation. The final design for both systems called for combustible cases (reportedly to be supplied by Yugoslavia) rather than bagged increments. Non-electric initiation was evaluated in 1988 for safety and reliability factors (static electricity being a hazard in low humidity), but was apparently not further considered. The System 350 guns were designed to use a six-increment propelling charge scheme, and this same scheme has apparently been chosen for the System 1000. There is no indication that the guns would be fired with varying propelling charges; the increments were simply used to simplify loading. [redacted]

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Project BABYLON—The Development, Capabilities, and Status of Iraq's "Super Gun" (U)

Committee Intelligence Report

Weapon and Space Systems Intelligence Committee

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EMPLOYMENT CONSIDERATIONS

The most frequently asked question about the "Super Gun" development has been why anyone would want to develop such an expensive system to accomplish what surface-to-surface missiles (SSMs) already do quite effectively. A "Super Gun" of extremely large caliber is not mobile, and it cannot shift from one target to another. Additionally, the "Super Gun" is much more expensive to design and build than a comparatively simple SSM transporter-erector-launcher. Dr. Bull's claim that the system could be completed for $10 million was clearly optimistic, and costs are assessed to have already exceeded $20 million. The fact that Project HARP was canceled in 1967 and that no government except Iraq expressed any interest in the concept clearly indicates strong skepticism about the concept and its viability. (U)

As recent events have shown, short-range SSMs can be intercepted and destroyed prior to reaching their intended target. This is in part because the SSM launch can often be detected and the missile tracked during the relatively slow initial portion of its trajectory. The "Super Gun" offers an immediate advantage over the SSM in this respect since the projectile is "launched" at hypersonic speeds and emits no large tell-tale heat plume. This reduces (but does not eliminate) the ability of radars to track the projectile and decreases the available response time. Conversely, the fact that the gun is immobile simplifies launch detection since it can be observed at a single, fixed point. This is the same limitation inherent in silo-based SSMs.

SSMs and GLRs are similar in a number of respects, both involving an increase in range that requires a greater initial boost. In an SSM, this requires a large first stage which is separated after motor burnout. In the case of a GLR, the "first stage" is the gun, and separation is the exit of the GLR from the muzzle. Comparing the two, the SSM's first stage must lift its own weight in addition to that of the warhead. Although the gun represents a much heavier "first stage", almost all of the initial boost is applied to the payload, providing a higher velocity from the same amount of thrust. Additionally, since the GLR has a higher initial velocity, it is less susceptible to meteorological effects in the firing position. The GLR can be designed with multiple stages like an SSM to increase its range, although this may decrease payload.

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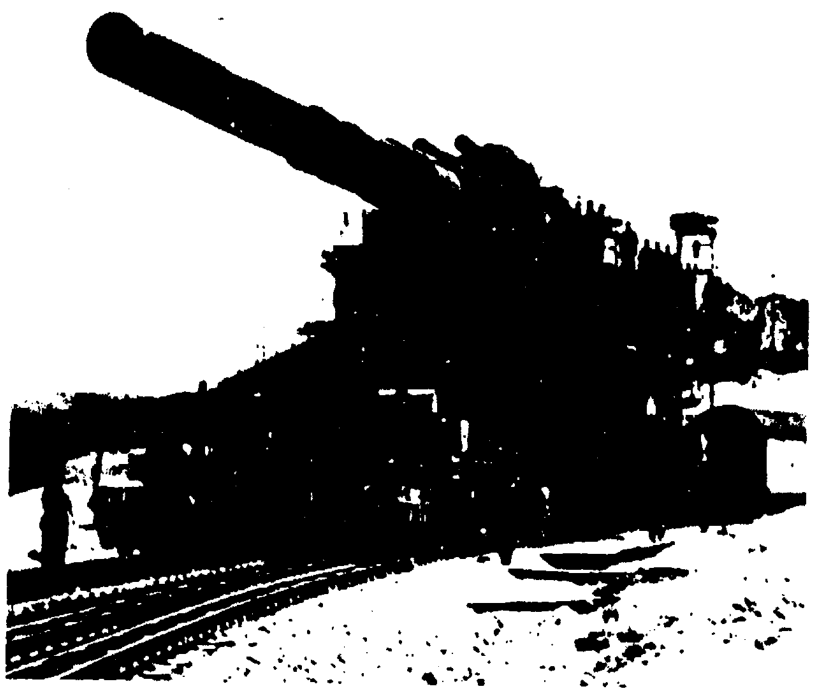

Figure 1. German 800mm Railroad Gun--"DORA" (U)

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differently due to the greater size of the projectile. We assessed that the civil engineering plans were similar to those of the System 350. (U)

"Conventional" Projectiles

The only identified "conventional" projectiles developed are for the 350-mm gun. A projectile for the 1000-mm gun was reportedly under development. [redacted]

The first true projectile (as opposed to a test slug), apparently fired during testing, was a discarding-sabot, fin-stabilized projectile designated the S32. It was apparently used for charge development and ballistic testing and initially did not contain any payload. This projectile was used in test firings from each of the 350-mm gun systems, during which muzzle velocities between 2000 and 2200 meters per second reportedly were achieved. Projectile design was altered throughout the program, but apparently only emphasized decreasing the weight of the sabots. These efforts had reportedly resulted in a lower shot weight and attendant increases in range. The initial firings were apparently conducted with steel sabots and later firings with aluminum sabots. The final sabot design called for the use of composite materials, but this effort was apparently never completed. [redacted]

The original 350-mm "conventional" projectile "technology demonstrator" was designated the S43. It was successful enough to lead to the development of a modified 350-mm projectile with a high-explosive payload--the S44. The shot weight of the latest version of the S44 was 135 kg, producing a maximum range of 428 km. This was reportedly a 10 percent range increase, principally due to a modified sabot design. Because it used fixed fins, the S44 had relatively large sabots and a small, 15-kg payload. Although no details about the guidance scheme are available, the S44 was configured for the retrofit of a canard-controlled G&C package. [redacted]

A "conventional" projectile designated the S31 had been designed for the System 1000. Like the S44, it apparently was not fitted with a rocket motor but was intended to include a G&C package and use canard control surfaces. There is no confirmation that any such projectiles had been produced. [redacted]

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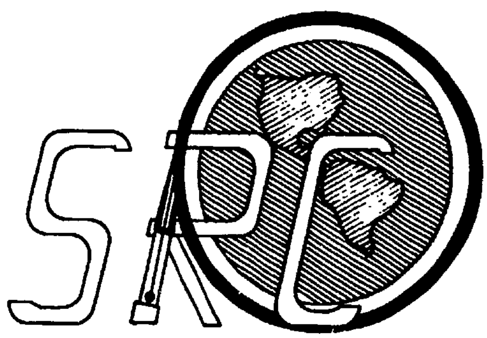

Figure 2. The SRC Corporate Logo (U)

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Project BABYLON Phase II

The second phase of Project BABYLON was the development of a guidance and control (G&C) mechanism for the GLR. The ATI engineers clearly indicated that the unguided projectile was not accurate enough for weapon purposes, and required some form of guidance. Several guidance concept proposals were submitted to Iraq, ranging from a beam-riding system which controlled the GLR for a limited time after firing to a true terminal-homing system. This phase of the project was clearly the slowest to show progress and was the cause of the greatest friction between ATI/SRC and Iraq. [redacted]

Hypervelocity Research Facility

A hypervelocity research facility was associated with Project BABYLON. This portion of the program involved examining the aerodynamic performance of the different projectile and GLR designs using a medium-caliber gun, wind tunnel tests, and computer simulations. The wind tunnel research near Mosul seems to have proceeded with few problems. However, the live-fire testing with a medium-caliber gun was slowed by the lack of an effective camera to photograph the firings for subsequent analysis. The hypervelocity gun was a modified Soviet 130-mm M-46 which mounts a special-purpose-built cannon. The firing range for this medium-caliber gun (initially 138mm, subsequently increased to 141mm) is located near the Al Mussayib Artillery Test Range (Figure 6), adjacent to the Horizontal Test Site for the System 1000. The wind tunnel is located north of Mosul and supported by Mosul University. [redacted]

Manufacture and Supply of Components

The manufacture and supply of the components for Project BABYLON systems were the shared responsibility of Iraq and ATI. As part of their project management responsibilities, ATI personnel divided tasks between Iraq and ATI. [redacted]

The Iraqi tasks were generally related to civil engineering, but in several cases, components of the various systems were manufactured in Iraq. The most important components were manufactured by a variety of European firms in accordance with designs and plans prepared and supplied by ATI. It is uncertain how many of the components could internal ballistic testing. This gun was emplaced at a site near Sinjar, along the Syrian border. Apparent project delays forced a modification of this system and, in November 1988, Brigadier Azzawi agreed to a design change suggested by Dr. Bull. Rather than employ a full 150-caliber cannon at Sinjar, two smaller test rigs were designed and used. The first of these rigs consisted of the powder chamber and approximately 5 meters of cannon and was used to initially evaluate the propelling charge. The final System 350H was a full, 150-caliber system used for firing tests with reduced propelling charges. (Full propelling charges may also have been used, but this cannot be confirmed.) The facility consisted of the cannon mounted on a concrete firing pad and an earthen berm into which projectiles were fired. Adjacent support buildings provided ammunition storage and control facilities during firing tests. Since the Iraqis planned to disassemble the cannon frequently for examination of the bore and seals, the cannon's sections were mounted on railway bogies for easy movement. For the final system, the bogies were connected so the movement of the entire rail-mounted system acted as the recoil mechanism. The mobility also enabled pendulum testing to determine the magnitude of the recoil forces. A total of 11 test firings into the berm were apparently conducted with this cannon. These firings used both a test slug (designed simply to exercise the recoil mechanism) and prototypes of the discarding-sabot conventional projectiles. The entire System 350H was apparently disassembled in March 1990 at the conclusion of these test firings, and the components of the cannon were transferred for use on the inclined cannon. [redacted]

System 350 L150

The complete, 150-caliber-length, 350-mm cannon has been referred to as the System 350 L150, the System 350, and the Inclined Launcher. It was emplaced along the side of a hill at a 45° incline and cannot be traversed or elevated. The System 350 was assembled in March 1990 at a facility in the Sabal Hamrin--Hamrin mountain range (Figures 3 and 4). Located southwest of Kirkuk in northern Iraq, the site was apparently chosen for its remote location and the fact that it allowed test firing, at long range, into the desert of southwest Iraq. The cannon is oriented on an approximate azimuth of 235° (± 8°). With this orientation it would be possible for suitable GLR, fired from the System 350, to land in Israel which may have been an Iraqi consideration.

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SUMMARY

Saddam Hussein, apparently intrigued by the prospect of the political prestige and military capability of a "Super Gun," decided to invest the time and money required for its development. [redacted]

Work completed prior to August 1990 was generally successful and demonstrated the viability of the "Super Gun" as a long-range bombardment weapon. Testing of the System 350 developmental cannon had been completed and further testing was being concentrated on ammunition developments. Testing and development of the System 1000 150-caliber, fixed-orientation cannon had apparently not been started and was seriously affected by the seizure of components, the UN imposed economic embargo, and the war against Iraq. Testing of the System 1000 at the horizontal test site had not begun, since the civil engineering work was not completed. It is unlikely that Iraq would have been able to employ the System 1000 from a firing position for at least one year, even if the embargo had not been implemented. The loss of any critical system components or foreign expertise could halt work on the System 1000. A weaponized version of the System 350 known as System 350ET had been designed and several components constructed. The seizure of critical components in Europe and the trade embargo against Iraq effectively halted the construction of the System 350ET. Although the civil engineering at the System 350ET emplacement site has reportedly been completed, it remains unlocated. [redacted]

No guided projectiles are available for Project BABYLON, and it is unlikely that any could be procured in less than two years. Without guided projectiles, Project BABYLON's guns cannot effectively engage point targets, and their effectiveness against area targets would be limited. We assess that high-explosive-filled conventional projectiles and gun-launched rockets (GLR) have been available in limited quantities for the System 350. A conventional projectile, capable of delivering a 14-kg payload to a maximum range of 428 km, had been developed and fired. The GLR may be able to deliver a 100-kg payload to a maximum range of 1000 km. The plans for the GLR were finalized and delivered to Iraq in early 1990, but we believe there is little chance that these projectiles have been produced. Although the effectiveness of a small payload would be increased by using a biological warfare (BW) agent fill, there is no conclusive evidence that such a payload has been designed or engineered. [redacted]

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PROJECT BABYLON

General

Dr. Bull found support for his project in Iraq. Saddam Hussein was clearly intrigued by the possibility of constructing a cannon system which would allow him to shell both Israel and Iran and which had intercontinental potential. Known as both Project BABYLON and Project 839, the development of Iraq's "Super Gun" began in the mid-1980s. In order to facilitate the design, manufacture, and testing of the "Super Gun," Dr. Bull established a separate company, although the design work was accomplished by SRC personnel. [redacted]

Advanced Technology Institute

The organization established to manage Project BABYLON was the Advanced Technology Institute (ATI) in Athens, Greece, and its director reported directly to Dr. Bull in Brussels. The ATI was apparently organized into the following groups/offices:

Group	Area of Responsibility
Electronics Group	Computer Support, Guidance and Control Mechanisms
Design Office	Detailed Design, Liaison with Suppliers
Drawing Office	Preparation of Design, Diagrams and Documentation
Range Team	Support of Firing Tests
Support Staff	Contracting/Administration

An ATI office was established in Baghdad to coordinate work within Iraq. There are several indications that an additional office was established in Belgrade, Yugoslavia, but this cannot be confirmed. Available information implies that a second project management office may have been established in Brussels. Although not directly linked to SRC, ATI operated closely with SRC subsidiaries with all work paid for by ATI. [redacted]

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[redacted]

ultimately be manufactured in Iraq, but quality control (QC) inspections of some Iraqi-produced components conducted by ATI personnel in late 1989 revealed that Iraqi factories were clearly becoming more skilled. [redacted]

ATI's responsibilities included locating and negotiating with the appropriate suppliers, performing QC inspections, and then arranging shipment to Iraq. The companies known to have been selected by ATI were based in the United Kingdom, Spain, Germany, Switzerland, Italy, the Netherlands, and Belgium. In the later stages of the project Yugoslavia was apparently added as both a supplier and a design/test site. [redacted]

The payment for these components was apparently the cause of some friction between ATI and SOTI. SOTI apparently established and controlled the necessary letters of credit, but on occasion ATI would purchase components and then be reimbursed by SOTI. By February 1990, SOTI had begun withholding a reported 25 percent from all monthly payments due to ATI's failure to meet agreed-upon schedules. [redacted]

Future Developments

Some indications are that ATI had begun work on Project BABYLON Phase III (sometimes also referred to informally as BABYLON II), about which nothing further, including Iraq's view of such a development, is known. In February 1990, ATI did draft a proposal for a 600-mm weapon which would provide greater flexibility than the System 350ET and would fire larger projectiles. This proposal summarized the problems associated with the delivery of subcaliber projectiles from the System 350 and suggested the larger system as possibly a mobile weapon. Iraq apparently declined the proposal. [redacted]